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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/797,422	03/10/2004	John Frederick Ackerman	GEAE-0011-DV1	4370

49305 7590 10/04/2006

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ART UNIT	**PAPER NUMBER**
1762	

DATE MAILED: 10/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/797,422
Filing Date: March 10, 2004
Appellant(s): ACKERMAN ET AL.

MAILED
OCT 04 2006
GROUP 1700

Eric W. Guttag
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 8/30/2006, correcting the appeal brief filed 6/9/2006, appealing from the Office action mailed 1/17/2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

US Patent 5,324,544	Spence et al.	June 28, 1994
US Patent 5,871,820	Hasz et al.	Feb. 16, 1999
US Patent 6,274,193	Rigney et al.	August 4, 2001

Ceramics and Glasses, Engineered Materials Handbook. Volume 4. 1991. ASM international. Pages 752-753.

"Impregnate" as defined by www.m-w.com/dictionary

"Infiltrate" as defined by www.m-w.com/dictionary

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 17-25, 27-30, 32-35 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5324544 by Spence et al. ("Spence") in view of US Patent 5871820 by Hasz et al. ("Hasz").

Claims 17-18, 23, 32, and 35: Spence teaches of a method for protecting a metal gas turbine component, in an assembled state, from environmental contaminants using

an alumina-silica coating (abstract). Spence discloses application of the mixed oxide coating to various substrates, including ceramics and metal alloys (Column 4, lines 27-42). Spence discloses using a turbine element with a subcoat or bond coat to achieve bonding to the substrate and discloses such substrate include gas turbine parts which are susceptible to coke formation, such as nozzles, liners, and the like (Column 10, lines 35-37). Spence discloses providing an alumina precursor that will yield an aluminum oxide upon deposition to a substrate and a subsequent heat treatment from 1200 °F to 1500°F for complete curing of the coating (Column 4, lines 23-26, Claim 12).

Spence fails to teach protecting a thermal barrier coating comprising a non-alumina ceramic layer and a bond coat layer.

Hasz, teaching of a method for protecting a thermal barrier coating (TBC) from environmental contaminants, discloses providing a metal substrate with a thermal barrier coating consisting a ceramic layer, frequently yttria-stabalized zirconia, on a bond coat (Abstract, Column 1, lines 19-56). Hasz further teaches a protective layer is needed on thermal barrier coatings because they are susceptible to various modes of damage from environmental contaminants (Column 1, lines 45-56). Hasz discloses using a barrier coating comprising metal oxides such as alumina (Column 2, lines 28-31, Column 3, lines 46-50). Hasz discloses depositing the coating by coating methods known in the art such as sol-gel, sputtering, air plasma spray, etc. (Column 4, lines 25-30). Hasz discloses applying the thermal barrier coatings to metal turbine engine parts such as turbine blades, nozzles, combustion liners, etc. (Column 1, lines 32-36). Hasz also discloses this impermeable coating protects the TBC from infiltration of contaminants. In addition Hasz explicitly discloses, "infiltration or viscous flow of the

contaminant compositions into the thermal barrier coating cracks, openings, and pores is prevented" (Column 2, lines 54-64). Therefore, in order to be susceptible to infiltration, the ceramic TBC, as taught by Hasz, must necessarily have some amount of porosity.

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Spence to use the protective coating on a thermal barrier coating suggested by Hasz to provide a desirable protection from environmental contaminants because Spence teaches applying an alumina/silicon coating protects various substrates, including ceramic, from contaminants and Hasz teaches thermal barrier coatings, with outer layers of ceramic, benefit from a contaminant protective coating. In addition, the coating composition, as taught by Spence, is an aqueous solution, and Hasz teaches a liquid solution infiltrates the pores of the TBC, the coating material must necessarily infiltrate to some degree.

Claims 19-22 and 33-34: Spence discloses using organo-metallic compounds, such as aluminum alkoxides, for example aluminum sec-butoxides, ethoxides, and methoxides (Column 5, lines 11-17). Spence discloses using a sol comprising 78.3 parts methyl alcohol, 4.4 parts silica sol, and 17.3 parts aluminum sec-butoxide (Column 8 line 69 – Column 9 line 2). Spence discloses immersing a substrate in a sol and then firing for 5 hours at 1112 °F (Column 8, lines 58-64).

Claims 27-28 and 37: Spence discloses using an aqueous compositing including a solution of water and an organic solvent, such as organic alcohols, aldehydes, and ketones (Column 5, lines 21-29).

Claims 24 and 25: Spence in view of Hasz fails to disclose heating the aluminum alkoxide to a temperature or 1200 to 1500°F for at least 4 hours. However, Spence discloses immersing a substrate in a sol and then firing for 5 hours at 1112 °F (Column 8, lines 58-64). Spence also discloses a heat treatment from 1200 °F to 1500°F for complete curing of the coating (Claim 12). Therefore it is the examiners position that the length of time for a heat treatment is a result effective variable, as not enough time would not provide properly cure the coating providing the desired protective properties and too much time would not off additional benefits of more protection against environmental contaminants.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the optimal heat treatment time, in the process of Spence in view of Hasz, through routine experimentation, to provide the desired protective layer on a thermal barrier coating. It is well settled that determination of optimum values of these process parameters is within the skill of one practicing in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980).

Claims 29 and 30: Spence in view of Hasz fails to disclose treating the outer layer for a period of time from 1 to 5 minutes. However, Hasz discloses the importance of determining the appropriate coating thickness, where thick and thin coatings are possible (Column 4, lines 25-36). Therefore it is the examiners position that the length of treatment is a result effective variable, as not enough time would provide a less than desired coating thickness resulting in poor protective properties and too much time

would provide a coating thickness which does not offer additional benefit of more protection.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the optimal treatment time, in the process of Spence in view of Hasz, through routine experimentation, to provide the desired protective coating thickness onto the thermal barrier coating. It is well settled that determination of optimum values of these process parameters is within the skill of one practicing in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980).

Claims 26 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 5324544 by Spence et al. ("Spence") in view of US Patent 5871820 by Hasz et al. ("Hasz") and further in view of Ceramics and Glasses.

Spence in view of Hasz teach all the limitations of this claim, except they fail to explicitly disclose thermally converting the aluminum alkoxide to alpha alumina.

However, Ceramics and Glasses, discloses Al_2O_3, also known as alumina, is produced by heating hydrates of alumina through transitional structures to its final form, where all the transitional structures are transformed irreversibly to α- Al_2O_3, the only stable form at high temperatures (Page 752).

Therefore, it is the examiners position that the thermal treatment of Spence in view of Hasz inherently converts the aluminum alkoxide to an alpha alumina because it is disclosed by Ceramics and Glasses that alpha alumina results from thermal treatment of all aluminum hydrates.

The prior art and the present claims, reflected by claim 26, teach all the same process steps and thus the results obtained by Appellants process must necessarily be the same as those obtained by the prior art. Therefore by thermally converting the aluminum alkoxide to alpha alumina, it must necessarily result in finely divided alpha alumina. Either 1) the Appellant and the prior art have different definitions for an alpha alumina thermally converted from aluminum alkoxide, or 2) the Appellant is using other process steps or parameters that are not shown in the claims.

Claims 32 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6274193 by Rigney et al. ("Rigney") in view of US Patent 5324544 by Spence et al. ("Spence") in view of US Patent 5871820 by Hasz et al. ("Hasz").

However, Rigney teaching repairing a damaged turbine component, discloses removal of the entire thermal barrier coating, repairing the metal component at the discrete location of the damage and finally reapplying the thermal barrier coating to the outside of the refurbished turbine component (abstract).

Rigney fails to teach of applying an alumina coating to protect the component against environmental contaminants.

Spence in view of Hasz are applied here for the same reasons as applied to claim 32 above.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Rigney to apply the protective coating to the thermal barrier coating of a refurbished turbine component as suggested by Spence in view of

Hasz to provide a desirable protection of a thermal barrier coating for a turbine component because Spence in view of Hasz discloses a protective coating applied to a thermal barrier coating is known in the art to provide protection against contamination and therefore would reasonably be expected to effectively provide a refurbished turbine component with a outer thermal barrier coating with protection against contaminants.

(10) Response to Argument

Appellant argues against the Spence reference, stating the reference teaches coating a metallic substrate/component with a thin layer using sol gel. While Spence does disclose such a teaching, Spence also teaches applying the layer to bond coats and undercoats, including ceramics. Additionally, the examiner notes the rejection is based on the combined teachings of Spence and Hasz and not the explicit teaching of Spence.

The Appellant has argued against the examiners use of a dictionary to establish that infiltrating is synonymous with impregnating and the examiners use of the case law *In re Marra et al.*, 141 USPQ 221, where the art does no recognize any distinction between coating and impregnating. The examiner maintains this position. *In re Marra et al.* as presented by the Appellant "it would appear that a <u>porous material</u> like paper would be <u>impregnated to some extent</u> by an <u>aqueous composition applied</u>" (emphasis added). While the examiner agrees the coating, as taught by Hasz, discloses forming an impermeable coating, Hasz et al also discloses this impermeable coating protects the TBC from infiltration of contaminants. In addition Hasz clearly discloses "infiltration or viscous flow of the contaminant compositions into the thermal barrier coating cracks,

openings, and pores is prevented….the liquid contaminant composition is unable to penetrate the impermeable coating" (Column 2, lines 54-64). Therefore, in order to be subsequent to infiltration, the TBC, as taught by Hasz, must necessarily have some amount of porosity. Therefore as discussed by the Appellant, since the coating compositing is applied to a porous material, the "coating" composition would inherently impregnate, i.e. infiltrate. *See Remark, Page 7, Paragraph 2.* In addition, the coating composition, as taught by Spence, is an aqueous solution, and Hasz teaches a liquid solution infiltrates the pores of the TBC, the coating material must necessarily infiltrate to some degree.

The Appellant argues against the examiners position that the outer surface of Hasz has porosity and argues such is unsupported speculation. The examiner disagrees and directed the applications attention to the cited section of Hasz above, which clearly discloses a TBC with pores, cracks, etc., which are capable of being infiltrated by a liquid or gas.

In response to Appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would have been obvious to one skilled in the art at the time of the invention to modify Spence to use the protective coating on a thermal barrier coating as suggested by Hasz to provide

a desirable protection from environmental contaminants with a reasonable expectation of success because Spence teaches applying an alumina/silicon coating protects various substrates, including ceramic and bond/undercoats applied to metal turbine blades, from contaminants and Hasz teaches thermal barrier coatings, with outer layers of ceramic, benefit from a contaminant protective coating in turbine components. The prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375.

The Appellant has argued that there is no motivation to combine Spence et al. and Hasz et al. The Appellant has argued that the contaminants addressed by Spence et al, carbon deposits, are not similar to the contaminants addressed by Hasz, CMAS deposits, and one skilled in the art would not consider the teaches of Hasz et al relevant to Spence et al. Hasz et al is utilized here to show that thermal barrier coatings comprising an alumina barrier layer and a bond coating are susceptible to various modes of damage from containments. Hasz discloses the contaminants as materials that are in the engine, which deposit on the surface of the engine part, from air and fuel sources, and impurities to oxidation products and only uses CMAS as an exemplary showing (Paragraph 2, lines 20-21 and 32-35). The examiner agrees Spence et al. is directed to carbon deposits, more particularly, carbon deposits on fuel contacting surfaces located in high temperature zones of gas turbine engines, where the carbon deposits are a side effect of the fuels being consumed within the engine (Column 1, lines 11-25). Additionally, Hasz discloses applying the thermal barrier coatings to metal turbine engine parts such as turbine blades, nozzles, combustion liners, etc. (Column 1,

lines 32-36) and Spence discloses using a turbine element with a subcoat or bond coat to achieve bonding to the substrate and discloses such substrate include gas turbine parts which are susceptible to coke formation, such as nozzles, liners, and the like (Column 10, lines 35-37). Therefore it is the examiners position that the Spence et al and Hasz et al are relevant art because they both teach of protecting turbine engine parts from contaminants. Spence teaches applying an alumina/silicon coating protects various substrates, including ceramic, from contaminants and Hasz teaches thermal barrier coatings, with outer layers of ceramic, benefit from a contaminant protective coating. The prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375.

The Appellants repeat the argument against the combination of Spence and Hasz with regard to "infiltration", which has been addressed above and therefore will not be repeated here.

The Appellant has argued against the Hasz reference stating they form an impermeable coating, rather then reservoirs of alumina. The examiner notes the claims utilize open language and are therefore open to other steps. Therefore the Appellant's claim is not limited to including only reservoirs of alumina, which "freeze" the contaminants, and only requires in situ thermal conversion of the infiltrated alumina. The coating composition, as taught by Spence, is an aqueous solution, and Hasz teaches a liquid solution infiltrates the pores of the TBC, the coating material must necessarily infiltrate to some degree, and Spence discloses after coating thermal conversion, which clearly converts the infiltrated alumina in situ.

The Appellant has argued Spence and Hasz teach the opposite because they disclose coating having “clearly defined interface between” the coating and the component. The examiner cannot locate such a statement in either Hasz or Spence to illustrate such a “defined interface”, therefore such an argument must be deemed mere attorney speculation unsupported by factual evidence.

The Appellant argues against the examiners position that the outer surface of Hasz has porosity and argues such is unsupported speculation. The examiner disagrees and directed the applications attention to the cited section of Hasz above, which clearly discloses a TBC with pores, cracks, etc., which are capable of being infiltrated by a liquid or gas.

In response to Appellant's argument that the references fail to show certain features of Appellant’s invention, it is noted that the features upon which Appellant relies (i.e., reservoir of alumina to react with the contaminants to form a third phase) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The Appellants argue the reservoir of alumina is the infiltrated alumina present in the porous outer layer. The examiner notes, however, that the claims do not exclude a coating on the porous outer layer wherein a portion of the coating infiltrates the porous layer. Therefore the Appellant’s reliance on a “reservoir of alumina to react with contaminants” is not recited in the claims. In other words, the claims do not require the contaminants to react with the reservoir of infiltrated alumina.

The Appellants argue the claim requires "in an amount sufficient to provide, when converted to alumina, at least partial protection of the thermal barrier coating against environmental contaminants that become deposited on the exposed surface", wherein the claimed amount is the reservoir of alumina. The examiner disagrees with such an assertion and cannot locate any language in the claim to limit the amount to a reservoir of alumina. In other words, the claim language is clearly open to a coating on the TBC to protect the TBC against any contaminants that are deposited on the exposed surface. It appears as though the Appellant is interpreting the claim language to narrow, wherein exposed surface, does not limited the claim to exposed surface of the TBC, but a surface exposed to contaminant deposition.

The Appellant has argued neither Spence or Hasz teach of length of treatment time. While the examiner agrees, such a length of treatment time is not taught, there is inherently a time, and the time is clearly a result effective variable as stated by the examiner and it would have been obvious for one of ordinary skill in the art to optimize such a treatment length to insure proper coating thickness. Hasz discloses the importance of determining the appropriate coating thickness, where thick and thin coatings are possible (Column 4, lines 25-36). Therefore it is the examiners position that the length of treatment is a result effective variable, as not enough time would provide a less than desired coating thickness resulting in poor protective properties and too much time would provide a coating thickness which does not offer additional benefit of more protection. It would have been obvious to one of ordinary skill in the art at the time of the invention to determine the optimal heat treatment time, in the process of Spence in view of Hasz, through routine experimentation, to provide the desired

protective layer on a thermal barrier coating. It is well settled that determination of optimum values of these process parameters is within the skill of one practicing in the art. See *In re Boesch*, 205 USPQ 215 (CCPA 1980).

The Appellant has argued against the prior art stating none of the prior art cited or reviewed by the examiner teaches of a turbine component in an assembled state. The examiner respectfully disagrees, where the component as taught by Spence is clearly in "an assembled state", where such a term is given its broadest reasonable interpretation. In other words, it is the examiners position that the turbine parts are assembled to a degree prior to coating and it appears as though the Appellant is interpreting the claim too narrow in requiring the part to be in a final assembled state on an engine or the like. Both Spence and Hasz clearly disclose turbine components as substrates as discussed above and would necessarily be "assembled".

The Appellant has argued against the Ceramic and Glasses reference stating that is does not teach forming finely divided alpha alumina. However, the prior art and the present claims, reflected by claim 26, teach all the same process steps and thus the results obtained by Appellants process must necessarily be the same as those obtained by the prior art. Therefore by thermally converting the aluminum alkoxide to alpha alumina, it must necessarily result in finely divided alpha alumina. Either 1) the Appellant and the prior art have different definitions for an alpha alumina thermally converted from aluminum alkoxide, or 2) the Appellant is using other process steps or parameters that are not shown in the claim. The Appellant has requested an affidavit from the examiner defending the position above, however, such an affidavit is not necessary. The claim, which requires converting to finely divided alumina, only requires

thermal conversion of the aluminum alkoxide, where the prior art clearly discloses thermal conversion in situ and therefore both the reference and the Appellants claim require the same process steps. Therefore, the examiner maintains the above position, where thermal conversion must necessarily result in finely divided alpha alumina because the Appellant arrives at such using the same process steps.

In response to Appellant's argument that there is no suggestion to combine Rigney, Spence, and Hasz, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Rigney teaches of repairing a damaged turbine component, discloses removal of the entire thermal barrier coating, repairing the metal component at the discrete location of the damage and finally reapplying the thermal barrier coating to the outside of the refurbished turbine component (abstract) and one would be motivated to modify Rigney to apply the protective coating to the thermal barrier coating of a refurbished turbine component as suggested by Spence in view of Hasz to provide a desirable protection of a thermal barrier coating for a turbine component because Spence in view of Hasz discloses a protective coating applied to a thermal barrier coating is known in the art to provide protection against contamination and therefore would reasonably be expected to effectively provide a refurbished turbine component with a outer thermal barrier coating with protection against contaminants.

The Appellant argues against the combination of Rigney, Spence, and Hasz stating Rigney clearly discloses applying various types of distinct coatings during the repair, none of which are related to the coatings as taught by the combination of Spence in view of Hasz. However, the examiner notes Rigney clearly discloses providing a repair with an outer TBC and taking the references collectively one would be motivated to modify Rigney to apply the protective coating to the thermal barrier coating of a refurbished turbine component as suggested by Spence in view of Hasz to provide a desirable protection of a thermal barrier coating for a turbine component.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

David Turocy

AU 1762

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